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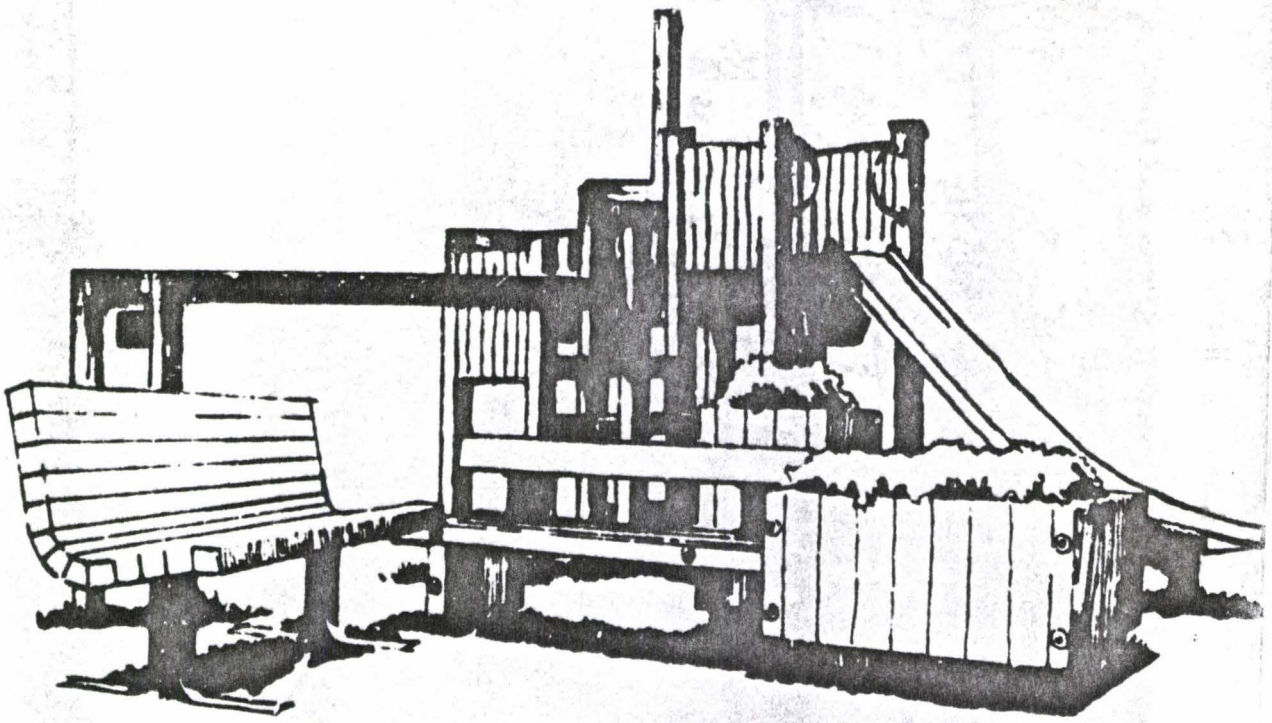
A CONSOLIDATED LITERATURE SEARCH TAYLORED TO INFORM AND PROVIDE GUIDANCE IN THE SAFETY AND SELECTION OF WOOD PLAY SYSTEMS, STRUCTURES, AND ASSOCIATED PRODUCTS FOR APPLICATION ON NATIONAL FOREST LANDS

BY
MASON C. MILLER, JR.
LANDSCAPE ARCHITECT



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MASON C. MILLER, JR.
LANDSCAPE ARCHITECT
OUACHITA NATIONAL FOREST, R-8
P. O. BOX 1270
HOT SPRINGS, ARKANSAS 71902
(501) 321-5253
DG: M.MILLER:R08F09A

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ABSTRACT

AUTHOR: MASON C. MILLER, JR.
LANDSCAPE ARCHITECT
OUACHITA NATIONAL FOREST, R-8
P. O. BOX 1270
HOT SPRINGS, ARKANSAS 71902
(501) 321-5253
DG - M.MILLER:R08F09A

TITLE: Consolidated Literature Search, Tailored to Inform and Provide Guidance in the Safety and Selection of Wood Play Systems, Structures, and Associated Products for Application on National Forest Lands.

ABSTRACT: As we implement the concept of our National Recreation Strategy, it is essential that we become attuned to the public for which we serve. We have had occasion to hear our publics request playground equipment in our campgrounds. This field project will be a contribution to this request and show that we are listening.

Designers who plan playground spaces and companies who make these products take on special responsibilities. Children are not typical consumers and have little or no concept of personal safety. Therefore, it is incumbent upon designers to provide the safest product available to the general public.

This document will provide project level designers with a consolidated literature search which will address criteria to help to properly analyze, evaluate, and purchase wood play system structures and associated products for application on National Forest lands.

Any Forest Service Landscape Architect, Designer, ORA, etc., with responsibility for designing playgrounds and associated products will find this report useful.

KEYWORDS: Wood Play Systems Consolidated Literature Search

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Introduction

While serving as Landscape Architect on the London Ranger District from 1981 to 1983, I had the opportunity to not only design, but live in a National Forest campground. During this time, I heard many requests from the public for playground equipment. At that time, it was Forest Service policy to refrain from supplying this type of equipment.

Thanks to F. Dale Robertson, Chief, U.S.D.A., Forest Service and his concept of the National Recreation Strategy, we are starting to listen and become attuned to the public we serve. This field project will be my small contribution to the public's request to show we are listening.

Designers who plan playground spaces and companies who manufacture these products take on special responsibilities. Children are not your typical consumer and, therefore, have little or no concept of personal safety. It is, therefore, incumbent upon designers and manufacturers to provide the safest products available to the general public.

The objectives of this paper are to:

1. Discuss what I have learned about wood play systems and associated products through literature search.

2. To discuss what I have learned from folks on the ground.

3. To present some thoughts on maintenance and safety criteria for choosing play equipment and safety surfacing.

4. To present some thoughts on various manufactured play equipment and safety surfacing.

5. To provide a suggested maintenance program for play equipment.

6. Overall, to present a paper that will consolidate literature and save designers time in choosing wood play systems and associated products.

The information in this report can be used to develop playgrounds in National Forest campgrounds across the nation. More specifically, this information will be used to design new playgrounds on the Ouachita National Forest and bring existing playground systems up to CPSC (Consumer Product Safety Commission) compliance.

Literature Review

Wood play systems, structures, and associated products have been featured in a wide variety of periodicals, including Rodale's Children - The Guide for Parents, Play for All News - Fall 86, 87, 88, The Fairfax Connection, Parks and Recreation Magazine, Nation's Cities Weekly, Washington, D.C., Southern Living, Chicago Tribune, American Association for the Childs Right to Play, Children's Environments Quarterly, Reader's Digest, Allied Chemical - Recreation Surfaces, Movemen, Education Newsletter.

Several technical publications on playground equipment and playground surfaces have been published, including:

U. S. Consumer Product Safety Council (1981) A Handbook for Public Playground Safety, Vol. I: General Guidelines for New and Existing Playgrounds, Vol. II: Technical Guidelines for Equipment and Surfacing, Washington, D. C.: CPSC.

U. S. Department of Housing and Urban Development (1978). A Playground for all Children: Resource Book. Washington, D.C.: Superintendent of Documents.

Methodology

In order to inform and provide guidance in the selection and safety of wood play systems, structures, and associated products; it was necessary to complete a thorough literature search including interviews with company representatives, park superintendents, installers, designers, and user groups. This information helped me set the stage to properly analyze and evaluate these products.

The next task was to decide what aspect of these products to concentrate my efforts on in order to make valid informative decisions.

I quickly found through my research that safety was the primary consideration in the purchase of these products. I also found that purchasing safe equipment was not the only consideration. How the equipment is installed, maintained, and the quality of surfacing under it are important factors. Adult supervision is also very important, but hard to regulate. Aesthetic qualities were considered to insure the equipment would blend with the forest environment.

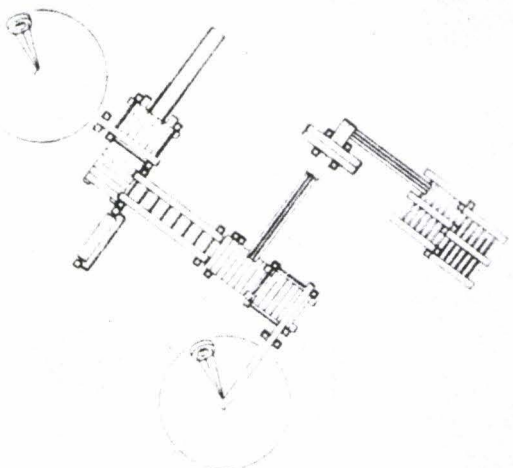
WOOD PLAY SYSTEMS

What is a wood play system? "Wood Play Systems," "Modular Systems," "Linked Play Modules," "linked equipment," "Linked Play Habitats" are all terms to describe a tradition in play equipment today.

The linked play concept began in the mid-1960's when New York Landscape Architect M. Paul Friedburg emerged as a leader in playground design. Because of his efforts, "linked play modules" have become the standard play structures throughout the recreation industry.

Early playground designs provided many separate play events to avoid competition and crowding. The uninviting and uninteresting facilities all too often went unused. This concept failed to recognize that children play in small groups. More recent concepts of linkage and concern for traffic flow have highlighted the use of decks and other linking devices such as balance beams to alleviate traffic flow problems.

Where the accent is on movement and large muscle activity, linked equipment settings are normally preferable to isolated pieces (Moore, 1974b).



According to Dallas Landscape Architect, Nan Booth Simpson, this interrelationship, referred to as "linking," is the key to a playground working successfully to develop the motor skills of a child. When each piece of equipment is related to the other piece, the child is encouraged to move from activity to activity, using a variety of skills such as balancing, climbing, jumping, bending, sliding, pulling, and hand-over-hand movement.

At each stage along the path, the "up-down," third dimension stimulates a special type of movement through space and encourages dramatic play. It is a basic dimension in spatial perception ("I'm higher than you." "I can see you, you can't see me."). (PLAY FOR ALL GUIDELINES: 1987)

According to Steve Atkins, Sales Engineering Manager for Miracle Equipment, Grinnel, Iowa, modular playground decks are growing in popularity. These units come in different sizes and can be constructed with a variety of slides, stairways, and climbing poles. "These give designers the opportunity to design equipment to meet their needs," Atkins says. "A designer can control the height, the type of activity, and the age group that will use the equipment."

When considering the purchase of wood play systems, the following criteria should be used:

Aesthetics Considerations

In order to confirm my own personal bias about the aesthetic considerations of wood play systems, I contacted several landscape architects, designers, and parks and recreation directors. They agreed the general public can and should legitimately require that playgrounds complement the natural terrain in which they are placed. A playground should be treated as a large outdoor sculpture formed as a collage of shapes, forms, colors, and textures which blend into the natural environment. Above all, these structures should be easily maintainable to remain aesthetically pleasing.

In a conversation with Landscape Architect Nan Booth Simpson, she states: you should ask yourself several questions before attempting to design any play area. What age children will be using the space? How many children will be playing at the same time? What site features (trees, slope, etc.) can be incorporated into the play structures? How large a structure or structures will the budget allow? Where will the playground be located? Are there any existing structures that can be incorporated into the new play system?

After completing a thorough site analysis, you should consider movement of children through the space. What structures can be bought or designed to incorporate the widest variety of motor skill activities? How many ways can be devised to get on and off the structure? How can the structures be linked together to suggest play patterns? Only then does the design become a whole greater than the sum of its parts.

In a phone conversation with Ed Hersh, Parks and Recreation Director of the City of Hurst, Texas, he "hits the nail right on the head" when he explains why his city replaced the old metal playground units in five areas with contemporary play structures and play systems: "We chose wood first for the aesthetics. It simply appeals to people. Plus, the best wood stands up to years of use and we've found that the maintenance is less than that required for most steel equipment. Even with the 'powder coatings' you find on some of the more contemporary steel systems, they will need painting on an annual basis. Wood blends in and the aging process adds to the aesthetic beauty."

"We've found the massiveness of wood to be very appealing to our visitors. Kids love it and it sparks their imaginations. Parents have confidence in the structural integrity of the big timbers. I personally think kids feel safer on

wood and it certainly is a much more inviting play environment than a jungle of metal. I'm not overly concerned about wood breaking or splintering because we buy only from the most reputable companies with a long track record of satisfied park and recreation customers. Columbia Cascade and BigToys are good examples."

"From a maintenance standpoint, if wood is carved on we can usually take a belt sander and fix it like new. To take the dryness out of the wood, we use a 50 percent linseed oil and 50 percent paint thinner mixture. Twice a week, we rake and maintain the peagravel surfacing around the play equipment. Every two weeks, we inspect for loose bolts and tighten if needed."

STRUCTURAL CONSIDERATIONS

Testing. When purchasing play equipment, it is difficult to determine which equipment has been tested. The CPSC recommends that consumers require manufacturers to furnish testing results of play equipment before purchasing.

Modular Systems. The manufacturers discussed in this paper all produce modular systems. These systems may be added to at any time, and also offer the ability to make changes when new products or safety trends surface.

According to Jim Edwards, Diversified Recreation, Inc., "Modular systems offer a multitude of design options." Above-ground systems, such as those produced by Columbia Cascade (Timber Form-2 and Interplay), "can save 25-30 percent on installation cost when compared to below-ground systems." These systems require no buried posts or concrete foundations. Several systems sold by Mr. Edwards were installed by parental groups.

MATERIALS

Wood. When purchasing wood play systems, whether above or below ground, be sure and request documentation of treated materials and residual arsenigens. Inspect the wood surface to be completely sure that no arsenigens are present.

Currently, there are two treatment systems that are being used by playground manufacturers (Copper Arsenate and NIEDOX-10). Copper arsenate is the treatment of choice for in-ground wood, provided that the treated surface is low in residual arsenic salts (4 percent solution is typical). Apply sealers or coatings over wood to more fully protect (PLAY FOR ALL GUIDELINES, 1987).

The Columbia Cascade Company has introduced an exclusive process referred to as NIEDOX-10. The NIEDOX-10 treatment is a boric acid and paraffin based formulation applied in an autoclave under heat and pressure. According to Lee Gjovilz, Research Specialist Wood Preservation, Forest Products Laboratory, Madison, Wisconsin, no testing has been performed at the lab on this process; therefore, no research information is available to confirm or deny the treatment.

Chains and Ropes. Many of the modular play systems I reviewed offer flexible cargo nets. These nets are often constructed of chain or polypropylene rope. Stay away from bare chain. It is "harsh and can produce pinch points" (PLAY FOR ALL GUIDELINES, 1987). One of the latest improvements is polyvinyl chloride (PVC) which has been used to coat the chain; this greatly improves the

safety as well as quality. Another newly developed composite material, wire cable woven within polypropylene rope, provides flexibility and durability.

Plastics. There are many high impact polyethylene plastics being used in playground equipment today. Spiral slides and molded side panels are just a few of the accessories to be considered.

Many manufacturers offer a variety of colors, including browns that blend with the natural environment.

Fiberglass is used for decorative elements, but it is not recommended because it has a low impact resistance.

HARDWARE

Protrusions. When considering the purchase of equipment, pay particular attention to protrusions. The equipment featured in this paper conforms to CPSC guidelines when considering the maximum allowable protrusion. If at all possible, visit actual installations to inspect equipment before you purchase. In any respect, no object should protrude more than its diameter (e.g., a 1-inch bolt no more than 1 inch).

Moving Joints. Moving joints (e.g., sealed joints, nylon bearings, roller bearings, bronze bushings, etc.) are a periodic maintenance item. Some equipment contains sealed joints, which require periodic inspection and record keeping. These joints cannot be broken down and must be replaced.

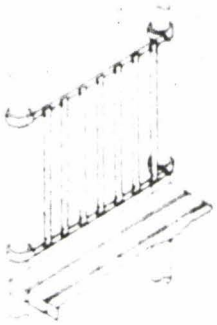
There are many moving joints on play equipment today such as Tire Swings, Belt Swings, cargo nets, etc.

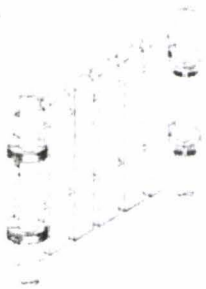
Be sure the equipment you purchase contains bearing connections and not simple metal-to-metal "S" hooks. Also, consider the ease in which these items are inspected and maintained.

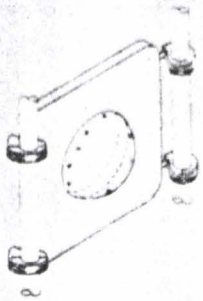
Vandal Resistant Fasteners. Many changes have taken place since the old spot welded hex head bolt to reduce vandalism. Current methods include fastening devices using special tools supplied by the manufacturers and threaded treatments to keep fasteners in place. When purchasing equipment, be sure fasteners are vandal resistant and protrusion free.

FINISHES

While much of the play equipment today still incorporates galvanized finishes, electrostatic "powder coating" has replaced many paints. "Powder coating" is an electrostatic process which applies epoxy, nylon, or polyester plastic as a very fine dry powder which is then oven cured and bonded to the surface of steel or aluminum (PLAY FOR ALL GUIDELINES, 1987). When considering this process, epoxy or lead-containing powder coatings are not acceptable. Many companies are now power coating over galvanized steel. When considering this process, be sure and analyze the price differential.





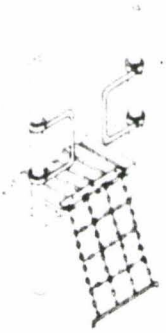


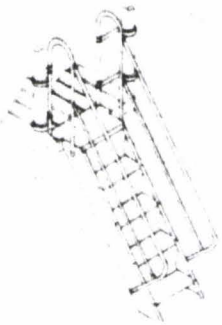
PLAY APPARATUS

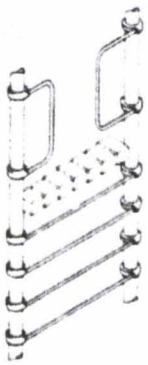
Enclosures. In multideck structures, enclosures are essential to prevent falling from one deck to the next. The CPSC recommends that all platforms above 30 inches be surrounded by "nonclimbable" enclosures at least 30 inches in height.

Some companies simply enclose the sides with a solid structure, but this approach greatly inhibits supervision.

There are four designs which seem to meet the CPSC guidelines, vertical wood slats, metal rails 3 to 4 inch spaces (meets CPSC entrapment specifications), panels with cutouts covered with clear plastic, or wire mesh panels. With any selection, be sure platform enclosures are at least 38 inches in height and present no entrapment or footholds for climbing.







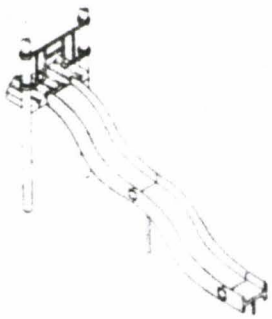
Motor Impairments. The CPSC recommends additional railing supports for children with motor impairments.

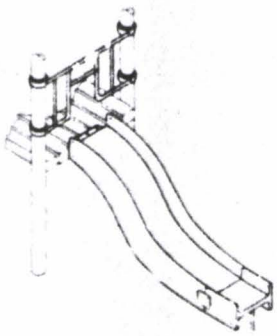
When there are changes in surface, activity, or elevation, additional support is needed. Vertical grips supply the needed security, and at the same time comply with CPSC Guidelines. When purchasing equipment, specify vertical grips at changes in surface, activity, or elevation, and provide continuous hand grips at one and two feet from the base of the platform.

Slides. Today, slides are still a very popular item. The days of the single-file ladder have come to an end. It has been replaced with a platform accessible from many directions. Many manufacturers (Columbia Cascade, Victor Stanley, Inc., Big Toys, etc.) have made slides wider and stronger; they've increased the height of the side rails and decreased the slide's angle of incline to 30-degrees (CPSC guideline). Look for slides that curve at the bottom. This allows the child to exit parallel to the ground slowing his or her rate of descent. The CPSC requires that slide exit zones be a minimum of 16 inches long, with a height between 9 and 15 inches.

A word of caution. Stay away from slides that descend straight to the ground at a 45-degree angle. These slides are easier and cheaper to manufacture, but they may cause injury to a child's spine.

As mentioned previously, side rails have increased in height. The CPSC recommends a 2-1/2-inch minimum. In some cases, this prevents an adult from sliding down with a child between his or her legs. The wider slides alleviate this problem and offer the advantage of group play.





When considering slide materials; stainless steel, plastic, and high density polyethylene are a few considerations. Stainless steel is a very durable material, but may cause second degree burns. To minimize this problem, it is recommended slides be installed pointing in a northerly direction or placed in

a shaded area. A second inherent problem to consider with low grade steel is the possibility of exposed razor edges.

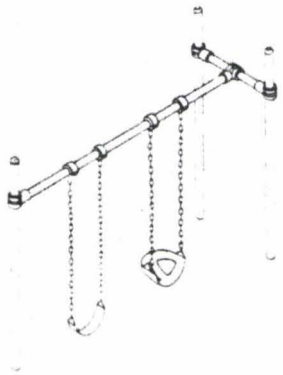
Plastic slides solve the problems of heat and exposed edges, but will not withstand intense heat and are subject to impact fracture.

Presently, "state of the art" slides are constructed of "ultraviolet ray stabilized polyethylene resin," resolving the durability problem while adding the element of color if desired.

Swings. Swings can take on a variety of forms, depending on the method of suspension, type of seat, length of arc, character of takeoff and landing, etc. The traditional double-hung swing (with a reinforced vinyl seat) is still probably the most popular piece of play equipment ever invented (Moore, 1986c, 1978b).

The CPSC points out that most swing seat injuries are the result of a swinging child hitting another in the swing's path.

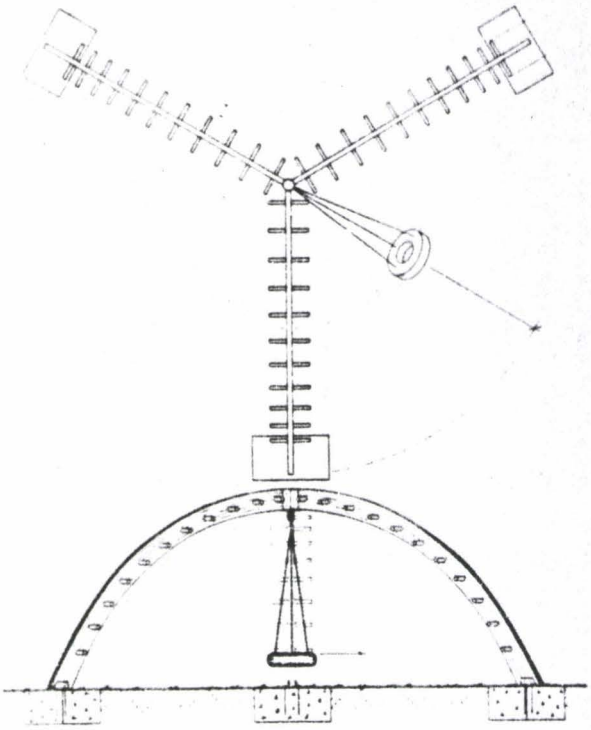
The CPSC recommends that accessible swings have a back and side support or a hole/indentation (as in a tire swing with a cloth or webbed bottom) for the child's backside.



The manufacturers mentioned in this paper recommend "swing use zones" when installing their equipment. In any case, swing systems should be isolated from other play equipment. The minimum setback requirement for swings is two times the height of the swing beam from any edge or obstacle. For tot and tire swings with low beams, this distance can be reduced slightly.

Tire Swings. One piece of equipment that shows up in many playgrounds today is the tire swing.

The most critical element you should be aware of when choosing this apparatus is the tire swing hanger, which appears in three types: ball joint, bearing, and universal joint.



The ball joints are a clean design and present no pinch points. A shortcoming of these joints has been their limited degree of motion which causes wear and eventual failure. Tire swings require about 170 degrees of lateral swing and most ball joints only provide about 145 degrees (PLAY FOR ALL GUIDELINES, 1987). Universal joints are not subject to such design limitations, but do, however, present pinch points. Most companies do provide a close-fitted rubber sleeve, and if well-designed and maintained, it provides protection from pinching.

Tire swings, since they move in all directions, require a beam support span which is two times the swing length plus 4 feet. A 12-foot span, common for this type of swing, would, therefore, be limited to 48 inches length of support chains and have a horizontal member height of 72 inches (PLAY FOR ALL GUIDELINES, 1987).

The tire component of a tire swing should, for example, be a new, clean, 4-ply model. Used or recycled tires are not acceptable since the chemical degradation of the tire will transfer making it difficult to remove carbon black material from the players' skin and clothing.

In summary, tire swing beams should be mounted at 72" with a permanent positive attachment of the bearing to the beam. Swivel assemblies should consist of a universal joint bearing, protected by a close-fitted rubber sleeve to prevent pinching.

MAINTENANCE. The need for a carefully planned and professionally administered maintenance program has become a critical aspect of public play provision (Root, 1983; Simm, 1985, PLAY FOR ALL GUIDELINES, 1987).

In conversations with several Parks and Recreation Directors across the country, their inspection intervals varied greatly depending on site usage and available manpower.

A basic inspection program should include the following:

1. Daily to weekly visual review of the play environment, inspecting for hazards as specified in an approved checklist.

2. Monthly to three times monthly recorded inspection by a trained operative using an approved checklist (FPC/NPFA, N.D.; Root, 1983).

3. Biannual to annual "teardown" inspection to examine features such as bearings footings for deterioration as detailed in manufacturer's specifications and on approved checklists.

4. A comprehensive maintenance program (NPFA, 1983) including staff training, provision of inspection checklists, prompt repair of discovered problems, follow-up quality assurance and detailed documentation.

Suggested Playground Equipment Maintenance Safety Checklist

ITEM	LOOK FOR. . .
Structures	Visible cracks, bending, warping, loosening, or breakage of any component.
Surface finish	No protective coating, rust, other corrosion, splintered, checking, cracked, or otherwise deteriorated wood, chipped or peeling paint, harmful preservatives or points.
Hardware	Loose bolts, nuts, missing, bent, broken, loosened, open hooks, etc.
Edges	Protruding bolt ends that do not have smooth finished caps and covers, sharp points or edges, etc.
Mechanical devices and other moving parts	Lack of lubrication on moving parts, worn bearings, missing protective covers; worn swing hangers and chains; deformation of open hooks, shackles, rings, links, etc.
Guard or hand rails	Missing, bent, broken, loosened, etc.
Ladders and Steps	Missing rungs or steps, broken, loosened, warping, bending, visible cracks, etc.
Swing seats	Missing, damaged, or loose swing seats; heavy seats with sharp edges or corners.
Footings	Footings exposed, cracked, loose in ground, etc.
Protective surfacing under equipment	Compacted, displaced or ineffective level, doesn't extend to potential impact area, worn or scattered, unsanitary, poor drainage; hard surfaces, especially under swings slides; broken glass, trash, rocks, roots, or other environmental obstacles.

Conclusion

Because each site, campground, age group, climate, and area of the country is different; you must choose and evaluate the play systems and safety surfacing that best fits your needs.

I hope the discussions and recommendations presented here will provide the basic framework to make informed decisions.

The types of play systems and safety surfacing discussed here are not inexpensive. Spending taxpayers' dollars on inferior products will cost extra dollars in the long run. Nan Booth Simpson puts it like this, "Starting with difficult and time-consuming installations and continuing to the replacement of broken parts and the repair and refinishing of under-designed components, the final cost will be much greater than anticipated. If a $10,000 premium quality play structure can be installed faster and more easily, lasts longer and requires less upkeep than an $8,000 "cheapie," which is the actual bargain?"

Mr. Hersh notes "The manufacturer is the most important element in the purchasing equation; it's the fly-by-nighters that will get you into big trouble. They'll tell you their stuff is just as good and they may save you a few bucks now. But you'll end up getting less than you paid for. The reputable companies stand by their products." Remember with these systems, you can always add later, by connecting with accessories such as overhead arch climbers, balance beams, and tunnel crawls.

In conclusion, if playground manufacturers would fashion their catalogs, design manuals, promotional materials, etc., toward the CPSC Guidelines, consumers and designers would be miles ahead. It is sometimes very difficult to determine if the equipment you are reviewing is safe. The catalogs could become the catalyst in promoting safety in playground systems, what better a place to begin.

PLAYGROUND SURFACING

In interviews with park superintendents, installers, company representatives, U. S. Consumer Product Safety Commission (CPSC), and designers; all were quick to point out "be sure and budget for safety surfacing." These people have recognized the fact that according to (CPSC) 1981, 60-70 percent of all public playground-related injuries are caused by falls from equipment to underlying surfaces. This fact cannot be stressed enough: resilient surfacing under playground equipment is essential for safe play.

The major objective of surfacing material is to reduce the impact to a child's head in the event of a head-first fall (PLAY FOR ALL GUIDELINES, 1987). To measure the resilient properties of a surface, the ASTM (American Society for Testing and Materials) has developed a process which requires dropping an instrumented head form in guided free fall and measuring linear acceleration response of the head form during impact.

G-force is the force of gravity on an object taking the weight of an object and distance of fall into consideration (PLAY FOR ALL GUIDELINES, 1987). The CPSC's principal standard of adequacy is the "under 200 G's impact attenuation" standard conducted according to ASTM F355-86 (Standard Test Method for Shock-Absorbing Properties of Play Surface Systems and Materials, 1986).

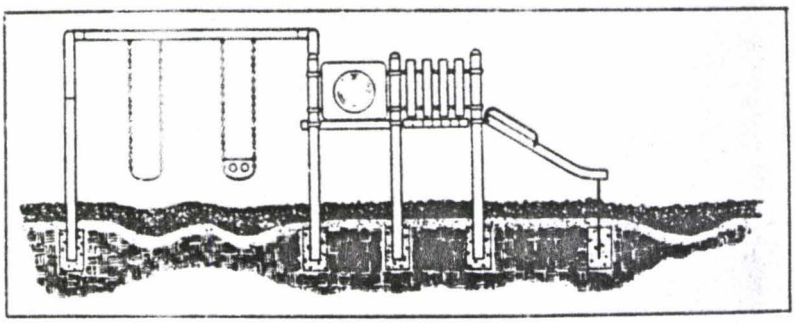
ASTM representative Jennifer Holiday informed me that over the past 3-1/2 years, the ASTM F08.52 task force has worked toward establishing a standard specification for measurement of impact attenuation of surface systems under and around playground equipment. Finally, through the combined efforts of manufacturers, architects, professors, engineers, and the U. S. Consumer

Product Safety Commission, the standard is expected to be in print by fall of 1989.

The need for such a standard has been demonstrated to me through my literature research in assessing the merits of such surfaces among a diversity of testing methods, agencies, and terminology. The goal of such a standard is to establish a uniform testing method to measure the shock absorbent characteristics of various surfacing materials. This will provide the potential consumer a way to accurately compare materials, thereby providing a safe surface on which children may play.

This standard specification will establish a standard test method for G-max and conditions that affect it such as drop height, high and low temperatures, etc.

Although the Consumer Product Safety Commission established guidelines for playground surfacing over 10 years ago, very few municipalities, schools, child care centers, etc., have followed them. This standard will go a long way in making playgrounds a safer place to play. During the interim period manufacturers should supply potential consumers with test results.



SITE TESTING

MAX G

In a conversation with Paul Hogan (1989) President, Playground Clearing House, Inc., and designer of MAX G SRT, Surface Resiliency Tester, he explains that up until now, it was very expensive to test on site for the 200 G force rating accepted by the CPSC.

The MAX G is a piseo-electric accelerometer approximately 12 pounds in weight and 6 inches in diameter, approximating the size of a child's head. By dropping this device from any height to any surface you can measure the G force of the surface. MAX G will measure ratings from 25-499 "G's." If the drop is

over 500 "G's," the read-out will go back to zero. There is a one-year conditional guarantee on the instrument. The only condition is that Max G not be dropped on obviously destructive material such as concrete or asphalt. Otherwise, the guarantee is unconditional.

The present cost of Max G (1989), with case and instructions, is $1,250 UPS freight paid. A deposit of 20 percent or $250 is required with an order. Delivery takes a minimum of 90 days from receipt of order.

MAX W

The Consumer Product Safety Commission has directed several pages of its Guidelines to Public Playground Safety to swing testing procedures.

To test the integrity of the swing seats, the CPSC recommends using the following test method:

Over a one-minute period, build up the weigh on a swing seat to a total of 1,200 pounds. After reaching the prescribed weight, maintain the weight for five minutes. If any part of the swing breaks - the seat, "S" hooks, chain, or top connections - then the swing has failed the test and must be brought up to standards.

Max W is a swing testing device which weighs less than 30 pounds, but can exert up to 4,000 pounds of pressure.

The heart of Max W is an off-the-shelf hydraulic jack. The brain is a specially machined conversion chamber which converts the unmeasured and unknown pounds per square inch of the jack into a cylindrical pressure chamber exactly one square inch in area.

After placing Max W in place, you spend one minute slowly pumping up to 1,200 pounds and then hold for five additional minutes. If any part of the swing assembly breaks or gives, then repairs or replacements must be made until the swing passes the test.

An additional use for Max W is to test the lateral strength of railings.

The CPSC recommends that railings must withstand 400 pounds of lateral pressure or a distributed load of 80 pounds per lineal foot of rail.

The present cost of Max W (1989), with case and instructions, is $875 plus postage.

For further information about Max G, Max W or other playground safety testing devices, contact: Playground Clearing House, (215) 935-1549.

FACTORS TO CONSIDER

Many types of playground surfaces can be found in our playgrounds today. The following is a discussion of these surfaces and their positive and negative values. Any surface you choose will require maintenance, some more often than others.

The following are factors to consider when purchasing safety surfacing:

When the ASTM standards and specifications are established in the fall of 1989, will the surface meet ASTM standards for measurement of impact attenuation under and around playground equipment?

What is the availability of the product?

Does a drop onto this surface from the height of the highest deck on your play structure result in A G-force rating of less than 200 G's?

Does the surface allow for water drainage?

Is it slip-resistant?

What are the installation requirements?

What are the maintenance requirements?

Can it be easily cleaned?

Will it look attractive and complement the appearance of your playground equipment and the surrounding area?

Is the surface durable and capable of withstanding extremes of temperature, frost, vandalism, etc.?

Is it easily repaired?

What is the warranty and estimated life of the surfacing material?

Available maintenance.

Budget: the higher the potential fall, the more expensive the protective surfacing.

What are the type of activities and intended use?

Organic Materials:

Organic materials, such as pine bark mini-nuggets, pine bark mulch, shredded hardwood bark, and cocoa shell mulch, etc., share the following characteristics (CPSC, 1981):

Cushioning properties depend on the air trapped within and between individual particles. In rainy weather or during periods of high humidity, these materials absorb moisture and tend to compact, thereby losing the trapped air necessary for protective cushioning.

With the passage of time; they decompose, are pulverized, become less cushioning, and need to be replaced.

When wet and exposed to freezing temperatures, they freeze and lose their cushioning protection.

When wet, they provide an ideal condition for microorganism growth which might allow transmission of communicable diseases.

Wind blows these materials, reducing the thickness necessary for adequate cushioning.

They are gradually displaced by the playing action of children, thereby reducing the thickness of protective layers in vital fall areas.

They harbor and conceal various insects (invariably harmless learning opportunities), animal excrement and other trash such as broken glass, nails, pencils and other sharp objects that can cause puncture and cutting wounds.

With use, they may combine with dirt and other foreign materials resulting in a loss of cushioning properties.

They may be deliberately removed (stolen) for use as mulch by residents.

They are susceptible to burning.

Generally, these materials require replacement and continuous maintenance such as leveling, grading and sifting to remove foreign matter in order to remain effective as cushioning materials.

Wooden equipment installed in organic surfaced areas will tend to have more problems with post deterioration than with inorganic surfacing materials.

A major benefit of wood-based fall cushions when compared to inorganic materials such as sand is that they are less abrasive when tracked into buildings.

When used to surface informal play, circulation, and social areas not under equipment; several of the above reservations that relate to reduction in impact absorbancy no longer apply. Under these conditions, organic materials provide a viable, wear resistant alternative to grass. They also provide children with useful "props" to support dramatic play.

Common Organic Surfacing Materials:

Bark Nuggets. The principal wood product used for surfacing under play equipment is bark nuggets from 1/2 inch to 1 inch screen size. Its [illegible] absorbing characteristic is due primarily to its compressibility.

On the negative side, bark nuggets tend to retain water and decompose over time. Their softness allows them to abrade which accelerates this process. Thus, in time, the nuggets are reduced to a soil-like composition. Some children are allergic to bark dust. When dry, it blows in their eyes.

Bark nuggets can get thrown around. This makes the play setting look untidy, and is hazardous and uncomfortable for pedestrians and ball players on adjacent hard surfaces. Bark nuggets are difficult for wheelchairs to wheel through and may be inaccessible for those with balance problems.

The initial cost of bark and its maintenance requirements make it an expensive alternative. Sawdust is occasionally used as a less expensive substitute, but it decomposes very rapidly and is not recommended.

Wood Chips. Wood Chips are in many ways preferable to bark nuggets as a surfacing material. Once matted down, wood chips provide a wheelchair accessible surface. Wood chips are readily available from Parks Departments or tree servicing companies, from "chippers" used in tree pruning operations. Chips come in different sizes. The smallest chips work best.

Suitability depends on the source. Coniferous chips are the best because the chips are not as splintery as hardwood, when first spread. Pine scent is an added attraction and the pine needles help to make a soft "mat." Softer hardwood such as sycamore does almost as well.

When wood chips are first put down, they are spikey and splintery, but these characteristics disappear with wear and weathering, and the chips soon "mat" into a comfortable play surface. They have good drainage, and provide an excellent habitat for insects. Children like to explore this microcosmic world for both living organisms and other "finds" like coins, bottle tops, and small plastic toys. Wood chips are much easier than bark nuggets or sand to police for broken glass, and do not attract cats and dogs. There are also manufactured wood chip products.

If wood chips or bark nuggets are used, be sure to:

Maintain a minimum of 12 inches of bark nuggets or wood chips in equipment areas, and a minimum of 4 inches in nonequipment ares.

Use chips rather than bark nuggets except where the initial abrasiveness of chips will be a problem.

Inorganic Materials:

Inorganic materials can be loose or compact. Loose materials (e.g., sand, pea gravel, blue stone dust, blue sandstone, crushed stone, etc.) share the following characteristics:

They can be blown or thrown into children's eyes.

They can be displaced by the playing action of children, thereby reducing the thickness of protective layers in vital fall areas.

They can harbor and conceal various insects, animal excrement and other trash such as broken glass, nails, pencils and other sharp objects that can cause puncture and cutting wounds.

With use, these materials may be combined with dirt and other foreign materials, resulting in a loss of cushioning properties.

With increasing amounts of moisture, sand becomes cohesive and less cushioning. When thoroughly wet, sand reacts as a rigid material when impacted from any direction.

When wet and exposed to freezing temperatures, these materials will freeze and lose their cushioning protection.

Pea gravel is difficult to walk on and impossible to roll through.

Generally, these materials require replacement and regular maintenance such as leveling, grading, and sifting to remove foreign matter so they will remain attractive as cushioning materials.

Compact inorganic materials include rubber matting, synthetic turf on asphalt base, etc. Many share the following characteristics:

They often must be used on almost level uniform surfaces and, therefore, are difficult to lay.

They may be subject to vandalism (defaced, ignited, cut, etc.).

Foreign materials may be trapped in certain products, making ideal conditions for microorganism growth which might allow for communicable diseases.

Common Inorganic Surfacing Materials:

Sand and pea gravel. These materials are most frequently chosen for fall cushioning under play equipment. Since they have no compressibility, their impact absorbing characteristics are due to their ability to deform to the shape of the falling child. They spread the area of impact while increasing its duration (a slow, large area impact is less injurious than a narrow quick impact).

Sand is preferable and more popular than gravel as an impact absorbing surface, and has been used throughout North America and Europe for many years (Los Angeles, 1987). Particles must be round in shape and as uniform in size as possible. Particles 1/32 inch or less will be significantly affected by the surface tension of water and tend to bind together when wet.

Particles larger than 3/8 inch have sufficient mass to cause serious eye injury when thrown. The type sand required is produced by interaction with water and exists in river and ocean deposits. It is sometimes known as washed river bed sand, grain, or bird's eye sand.

The species of original stone affects the longevity of sand. Hard sand will last longer than sand composed of soft stone particles. Because of the weight of sand, the major cost is transportation.

If sand is used as a surface material:

Maintain a minimum of 12 inches of sand.

Select sand composed of hard round particles between 1/16 inch and 3/16 inch diameter.

Institute a maintenance program appropriate to each play area.

If sand is used as a surface under play equipment, additional sand areas must be provided for sand play. Sand under and around equipment cannot serve both purposes. If additional sand areas are not provided, children will play in traffic areas, a potentially hazardous situation, and the products of their sand play will get stomped on, causing much frustration and unnecessary social conflict.

If sand is used as the primary fall absorbing surface, then it should be used in combination with manufactured resilient surfaces to provide access to the equipment.

Decomposed Granite. This material provides a good all-weather surface for picnic areas, pathways and around trees. It should not be used under play equipment.

Rubber Surfaces/Synthetic Compact Materials. Rubber surfaces have been used on playgrounds for decades. The traditional form is a one-inch thick interlocking mat with a waffle pattern on the underside. CPSC tests showed that it performed satisfactorily for falls less than four feet in height. More recently, other rubber surfaces have come onto the market that meet CPSC tests up to heights of 11 feet.

Chopped tire, installed to a six-inch depth, significantly outperforms other fall absorbing materials. Like sand and bark nuggets, it will spread outside its containment barrier. To prevent this, some suppliers add a flexible plastic binder. The material retains most of its fall attenuating characteristics, but the surface tends to deteriorate with wear and is subject to vandalism. To counteract this, a skin of the binder material or

artificial grass is added. Such composite materials are available up to three inches thick, affording protection up to a 10-foot fall.

These manufactured surfaces provide for wheelchair access and should be used on pathways which come within the fall zone of an equipment setting.

A major drawback of chopped tire and similar composite materials, with and without binders, is their flammability.

CONCLUSIONS

In order to respond to the needs of children and the growing popularity of play systems across the country, it is our responsibility as a government agency to provide a safe playing surface.

The public and private sectors' awareness of playground safety took great strides in 1988. It only makes good common sense that providing a good safe playground surface that meets the CPSC criteria is the best solution to reducing the number and severity of playground injuries.

In a conversation with Jim Edwards (1989), Diversified Recreation, Inc., he said many of the schools, municipalities, child care centers, etc., are upgrading their playgrounds with a safety resilient surface. He said that in the past these folks have said they just couldn't afford this "essential playground improvement." The same people are beginning to realize you can pay now or pay later by incurring the cost of hospital bills, rehabilitation and court costs, not to mention lawsuit settlements. It is up to each of us as designers and managers to prevent or reduce injuries rather than wait for the consequences.

APPENDIX A

Resources for Manufactured Surfacing Material

BJ's Park and Recreation Products (FALL-SAFE)
P. O. Box 15
Friendswood, TX 77546
(713) 482-0278

Breakfall, Inc. (BREAK FALL)
759 N. Milwaukee St.
Milwaukee, WI 53202
(414) 273-7828

Carlise Tire and Rubber Co. (Playguard)
P. O. Box 99
Carlise, PA 17013
(800) 233-7165

Fibar System (FIBAR)
823 West Street
Harrison, NY 10528
(800) - FIBAR-A1

Landscape Structures/Mexico Forge (Tuff Turf)
601 Seventh St. South
Delano, MN 55328
(800) 328-0035

Mitchel Rubber Products, Inc.
491 Wilson Way
City of Industry, CA 94744
(818) 961-9711

Reese Industries, Inc. (CUSHION-TURF)
P. O. Box 912
Prospect Heights, IL 60070-0912
(800) 222-2268

Sportec International, Inc. (security blanket)
1491 Sheridan Drive
Kenmore, NY 14217
(800) 835-0033

RESOURCES FOR MANUFACTURED PLAY SYSTEMS

BigToys
Northwest Design Products, Inc.
2601 South Hood Street
Tacoma, Washington 98409-4793
(800)426-9788

Model - Classic BigToys

Warranty

BigToys guarantees for two full years all parts of properly assembled equipment against defects in materials and workmanship.

BigToys guarantees for twelve full years from the date of original shipment, all wood components against failure due to checking or cracking and against deterioration from fungi or insects which impair the structural integrity of the unit.

BigToys guarantees for twelve full years from the date of original shipment all steel pipe components against deterioration which impairs the structural integrity of the unit.

Any replacement parts under this warranty will be furnished absolutely free of charge.

Installation/Design Assistance

Instructions and scale models provide step-by-step guidance for proper assembly.

Supervision assistance and professional installers are available through your BigToys representative.

List Price Range

All prices are quoted f.o.b. Tacoma, Washington. Packaged units range from $6,495 to $19,990. Individual components may be bought separately and unit configurations may be modified to meet your needs.

Columbia Cascade Company
1975 S.W. Fifth Avenue
Portland, Oregon 97201-5293
(503)223-1157

Models - TimberForm-2, Interplay, TimberForm Classic and TimberForm

Warranty

Columbia Cascade Company guarantees all equipment to be manufactured in accordance with its latest specifications or in accordance with "approved" drawings. If you feel there is a discrepancy, you must notify them within 30 days after receipt of equipment and provide them with at least 10 days to make

inspection. If they agree that a defect exists, they will make prompt replacement at no cost to the buyer. Job site labor or other costs are not included. No other warranty is expressed or implied, nor may a regional representative expand this warranty.

Installation/Design Assistance

Detailed erection drawings are supplied to assist in the proper assembly of all TimberForm structures and accessories.

TimberForm-2 and Interplay structures are erected with the aid of a scale-model along with detailed graphic instructions.

Columbia Cascade does not do installation work, however, their regional representatives can often provide names of experienced, local contractors whom they have worked with in the past (Regional Representatives for your area, call (800) 547-1940).

Design consultants are available to assist and advise you, particularly during the early stages of design when economics can often be affected.

List Price Range

Packaged Units

InterPlay - Prices range from $1,918 to $18,182
TimberForm-2 - Prices range from $3,320 to $23,740
TimberForm - Prices range from $1,275 to $17,075
TimberForm Classic - Prices range from $1,300 to $12,000

Individual components may be bought separately and unit configurations may be modified to meet your needs.

GameTime, Inc.
P. O. Box 121
Ft. Payne, Alabama 35967
(205)845-5610
FAX 205-845-2649

Models - Timb "R" Scapes, and Mod "U" log

Warranty

GameTime provides warranties on all materials and workmanship for one year, excluding vandalism. In addition, they offer a 10-year limited warranty on pressure-treated wood products, against decay and termites, a 3-year limited warranty on the 549 Slash-Proof Belt Seat and a 2-year limited warranty on Flexplay net products.

Installation/Design Assistance

Your local GameTime sales representative will assist you in design of your system.

GameTime provides illustrated installation instructions.

List Price Range

Packaged Units

Timb "R" Scapes - Prices range from $1,553 to $8,510.
Mod "U" Log - Prices range from $2,108 to $5,756.

Individual wood systems may be created by adding components to the basic platforms. Many components can be used interchangeably.

LANDSCAPE STRUCTURES/MEXICO FORGE
601 7th Street South
Delano, MN 55328
(612) 479-2546
(800) 328-0035

Models - Redwood

Warranty

Unless otherwise stated below, seller warrants that for a period of one year after delivery the structures sold by it will conform in kind and in quality to the specifications set forth in the Acknowledgement of Order and will be free of defects in workmanship or material. Seller further warrants:

Limited 10-year warranty on redwood 6"x6" upright post. This warranty covers failure due to deterioration and insect infestation which impair the structural integrity of the posts. The warranty does NOT cover damage due to checking and cracking which are natural tendencies of all wood products.

Limited 5-year warranty on spiral slides constructed of polyethene.

Installation/Design Assistance

Your local Landscape Structures/Mexico Forge sales representative offers a design service as part of their sales support (LS/MF sends a suggested maintenance program with each play equipment order).

List Price Range

Packaged Units

Prices range from $1,460 to $23,891

Individual wood systems offer unlimited combinations and configurations designed to meet any site or budget limitations.

PLAYWORLD SYSTEMS
New Berlin, PA
For your local distributor, call (800)233-8404

Models

Modular Wood (Redwood)
Wood Structures (Pressure treated, Southern Yellow Pine)
Wood Structures (Redwood)

Warranty

Playworld Systems guarantees all materials and workmanship, excluding vandalism and abnormal use for one year after date of invoice. For 12 years from date of original invoice, Playworld Systems guarantees against deterioration of pressure treated pine components which impair the structural integrity of the product. For a period of 10 years from the date of original invoice, Playworld Systems guarantees against failure due to deterioration of redwood post in ground which impairs the structural integrity of the unit. These warranties do not cover the cost of removing the damaged wood or the installation of replacements provided by the warranties. Also not covered is damage due to checking and warping which are natural tendencies of pressure treated pine. Claim on defects must be accompanied by a copy of original invoice.

Installation/Design Assistance

Playworld Systems provides installation instructions which will include detailed scale top view and footing drawings plus written instructions to assure proper installation of the modular wood structure.

Playworld Systems will assist you in designing a play system for your specific requirement. The modular concept provides flexibility and creativity in designing a unit that meets your site layout, user age, type of play, and budget considerations.

List Price Range - Packaged Units

Wood Structures

Prices (Redwood) range from $1,836 to $7,928
Prices (Southern Yellow Pine) range from $1,465 to $6,418

Modular Wood

Prices (Redwood) range from $2,951 to $8,893
Prices (Southern Yellow Pine) range from $2,433 to $7,616

TIMBERFORM MaxTreat™

Introducing an exclusive pre-treatment fabrication procedure from TimberForm that dramatically increases the effectiveness of the pressure preservative treatment process.

At TimberForm we can't leave well-enough alone. Just as the playground industry thought that it had done well-enough, we have just outdone our own (or anyone else's) achievements. But, you might ask, does such innovation bring real benefits to the playground the specifier, the buyer, and ultimately the player? We believe that in the case of TimberForm's unique MaxTreat process, the answer is a decided YES!

Background

For decades it has been known in the wood preserving industry that perforations in the faces of sawn timber enhance the penetration and retention of preservative solutions when impregnated in closed autoclaves under pressure. The effectiveness of incising relys upon the established fact that preservatives penetrated into wood much farther in a longitudinal direction than in a direction perpendicular to the faces of the timber. These incisions expose end-grain surfaces and thus permit longitudinal penetration.

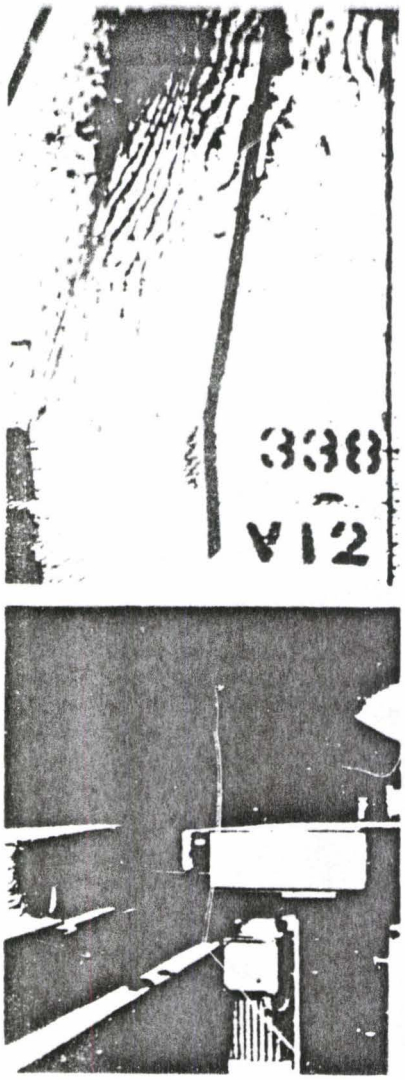
Special Application

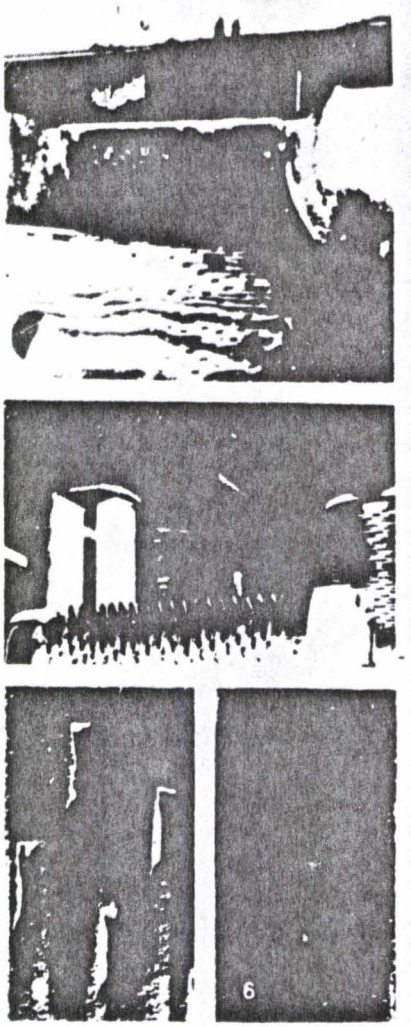
Commerical incising machinery widely used in the production, for instance, of railroad ties and bridge timbers, crudely puncture the timbers over their full length. These crude incisions, particularly when used on the playing surfaces of play apparatus, are absolutely unacceptable. With the TimberForm MaxTreat process, only posts destined for burial are incised and only that portion of those posts which will be embedded are incised to a point approximately one foot above grade. This incising pattern is well away from the playing surfaces, yet is in those critical ground contact areas where preservation must be most effective.

Research

Mindful of the effectiveness of incising, and looking for a way to further enhance the treatability of wood, scientists at the Oregon State University Forest Products Laboratory have developed, tested, and proven yet another technique for improving the preservative treating process. This procedure is called kerfing. Knowing that preservative solutions only penetrate a limited distance into the timber, and aware that future seasoning checks often expose untreated wood to decay causing organisms, it was discovered that a kerf (groove) cut into the timber prior to treatment, notably improved preservation results. This kerf is entered from the face of the timber which relieves natural, built-in stresses, thus preventing post-treatment seasoning checks from occuring, and further enhancing the integrity of the treatment process. This kerf is a maximum ¼ inch wide and extends laterally into a point one-half the thickness of the timber, and longitudinally from the bottom of the post to a point approximately one foot above the projected grade.

(continued)





1 A kerf (groove) is cut into the timber, in this case an 8" x 8" Play Cluster member, prior to preservative treatment. Also visible are the pre-treatment incisions made in all faces of the timber to a point one foot above ground level.

2 The kerfing and incising operation is the final link in the fabrication process.

3 & 4 The incising teeth produce 448 perforations per square foot, each to a depth of ½ inch by ½ inch long.

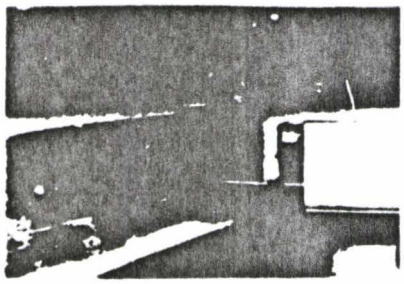
5 Actual size incisions before treatment.

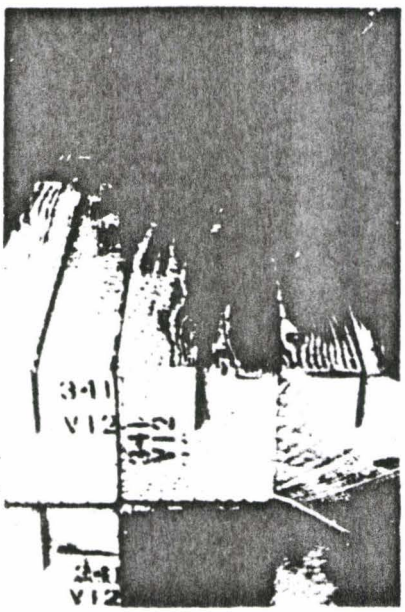
6 Incisions after pressure preservative treatment with NIEDOX-10 exhibits increased penetration surrounding the punctures.

Fabrication Before Treatment

TIMBERFORM® MaxTreat™

Introducing an exclusive process.





The Total Package

As in most new technical processes, no single factor is responsible for all of the improvements inherent in the procedure. Rather, the exceptional attributes of TimberForm MaxTreat is the final link in a combination of ingredients.

First and foremost is the choice of wood. At TimberForm we use only Douglas fir timbers, and only from trees grown west of the Cascade Range summit. This coastal sub-species has been shown to be more receptive to pressure treatment than species grown in inland environments.

Timbers are selected using a strict grading rule which demands suitability of strength, durability and appearance.

All wood used in the production of TimberForms must be fine grained and free-of-heart-center (F.O.H.C.). It has been long known that the use of F.O.H.C. timbers minimizes the effects of seasoning, reduces checking and enhances dimensional stability.

Secondly, after careful selection timbers are smoothly finished, all edges are carefully and uniformly rounded, and ends, which will be exposed on the final playground, are chamfered on four sides. Bolt holes are pre-drilled and, where indicated, counterbored for field insertion of wood plugs.

Thirdly, with all fabrication processes necessary for the erection of the equipment now completed, only the fabrication before treatment (MaxTreat) phase remains prior to pressure preservation treatment.

To accomplish this seemingly simple but technically difficult task, TimberForm developed a device which makes thousands of precise incisions only on those faces of the timber which are destined to be buried in soil or concrete. Thus the parts touched by humans remain smooth, and the parts most susceptible to attack by rot or decay organisms are incised and grooved to receive the maximum preservative treatment possible.

Additionally, to relieve stress (the major cause of timber checking and splitting) timbers are kerfed to the center of the piece from the butt of the timber up past the projected ground line. This unique kerfing process also allows the preservative treatment, under pressure, to enter the innermost reaches of the timber destined to be embedded below grade.

Finally, the timbers are pressure preservatively treated with NIEDOX-10, an exclusive non-toxic, water repellent, chemical formulation developed to prolong the life of wood by guarding against the attack of decay organisms.

At the completion of this series of steps, the timber play material itself has been enhanced almost beyond recognition. This is not just wood used on a playground; it is a carefully conceived product, selected, processed, refined, and preserved to enhance play for years to come.

Yes, there are many people producing play equipment from wood these days. TimberForm was the first, and is by any measure the world's leading producer of wood for play. The new MaxTreat process is just one more good reason for the thoughtful specifier to select TimberForm.

TimberForm MaxTreat™ Specifications

The following additions to section 2 of the TimberForm General Specifications should be incorporated into all future specifications.

2c. Incising

All timber posts destined for embedment shall be mechanically incised on all four faces by uniform hydraulic pressure to a depth of ½ inch by ½ inch long. The incising pattern shall produce a minimum of 448 perforations per square foot. Incisions shall begin at the bottom of the post and end approximately one foot above indicated grade. Full-length incising is not acceptable as the perforations may cause slivering problems on playing surfaces.

2d. Kerfing

All timber posts destined for embedment shall be kerfed (grooved) to half the cross-section depth, through one face. This kerf shall be a maximum of ¼ inch wide and shall extend from the bottom of the post to a point approximately one foot above indicated grade.

2e. Chronological Importance

To effectively receive pressure preservative treatment on all exposed surfaces of the wood, *all* timber fabrication, including incising and kerfing, shall be completed prior to treatment.

Columbia Cascade Timber Company

1975 S.W. Fifth Avenue
Portland, Oregon 97201 U.S.A.
503/223-1157
Telex 360-774

Your TimberForm Regional Representative is:

DIVERSIFIED RECREATION, INC.
5 WINGFIELD CIRCLE
P. O. BOX 5433
LITTLE ROCK, AR 72205

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Consumer Information Sheet

INORGANIC ARSENICAL PRESSURE-TREATED WOOD

(Including: CCA, ACA, and ACZA)

CONSUMER INFORMATION

This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing inorganic arsenic to protect it from insect attack and decay. Wood treated with inorganic arsenic should be used only where such protection is important.

Inorganic arsenic penetrates deeply into and remains in the pressure-treated wood for a long time. Exposure to inorganic arsenic may present certain hazards. Therefore, the following precautions should be taken both when handling the treated wood and in determining where to use or dispose of the treated wood.

USE SITE PRECAUTIONS

Wood pressure-treated with waterborne arsenical preservatives may be used inside residences as long as all sawdust and construction debris are cleaned up and disposed of after construction.

Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such sites would be structures or containers for storing silage or food.

Do not use treated wood for cutting-boards or countertops.

Only treated wood that is visibly clean and free of surface residue should be used for patios, decks and walkways.

Do not use treated wood for construction of those portions of beehives which may come into contact with the honey.

Treated wood should not be used where it may come into direct or indirect contact with public drinking water, except for uses involving incidental contact such as docks and bridges.

HANDLING PRECAUTIONS

Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with state and Federal regulations.

Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.

When power-sawing and machining, wear goggles to protect eyes from flying particles.

After working with the wood, and before eating, drinking, and use of tobacco products, wash exposed areas thoroughly.

If preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing.

Approved by the U.S. Environmental Protection Agency

APPENDIX E

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Forest Products Laboratory
Madison, WI 53705

4700-2
September 20, 1978

Mr. S. Kenneth Kirn
President
Cascade Pacific Lumber Co.
1975 S.W. Fifth Avenue
Portland, OR 97201

Dear Mr. Kirn:

It is not surprising that you hear conflicting reports on the durability of redwood that is exposed to ground contact. Enclosed is a short report that may help explain the reason. You will note that redwood is listed under the heading of resistant or very resistant to decay. Yet, in one of our post tests here in Wisconsin, redwood posts lasted only 3.6 years. It is our feeling that material well treated with a good preservative will outlast the most durable untreated species by a substantial margin.

Sincerely,

HARLEY L. DAVIDSON, Technician
Protection of Wood in Use

FOREST
COLUMBIA GAS

6200-11 (1/69)

APPENDIX F

SUMMARY OF SURFACING MATERIAL FOR USE UNDER PLAY EQUIPMENT

MATERIAL	FALL ABSORBING CHARACTERISTICS	ADVANTAGES	ISSUES TO CONSIDER
INORGANIC LOOSE MATERIAL (sand, gravel, stone dust, crushed stone, shells, rubber buffings, chopped tire, etc.)	Conforms to the shape of the falling child, spreading the area of impact while increasing its duration. The rubber products also trap air to provide cushioning.	Initial cost. Ease of installation. Does not pulverize. Not ideal for microbial growth. Generally non-flammable (except for rubber products.)	Environmental conditions can reduce fall absorbency. Can be swallowed, blown or thrown. Spreads outside the containment area. Conceals animal excrement and sharp objects.
Sand	As above. Particles should be round and as uniform in size as possible. Select sand composed of hard round particles between 1/16 inch and 3/16 inch diameter.	Low cost (major cost is transportation). Preferable and more popular pea gravel.	Small particles bind together when wet. Particles larger than 3/8 inch can cause serious eye injury when thrown. Species of original stone affects longevity. If used under play equipment additional sand areas must be provided for play.
Chopped Tire	As above. Chips come in different sizes; the smallest	Preferable to bark nuggets: lower cost, ease of maintenance. Easier to police for broken glass. Readily available.	Suitability depends on the wood source
Synthetic Compact Materials (rubber mats, synthetic turf on foam mats, rubber sheeting on foam mats, poured in place urethanes and rubber compositions)	Consists of a shock absorbing material such as rubber.	Low maintenance. Colors. Clean Consistent shock absorbency. No displacement. Generally low life cycle costs. Good footing. Accessible. Harbors few foreign objects.	Initial cost, replacement after useful life. Vandalism. Seams, loss of color, water drainage, slip resistant surfacing. 200 G-force rating. Ease of maintenance. Attractive and complementary to the appearance of the playground. Warranty and estimated life of the material.

RECOMMENDED DEPTH	MAINTENANCE REQUIREMENTS	ACCESSIBILITY	PLAY VALUE	COST
10-12 inches (Depends on Equipment Height)	Requires replacement and continuous maintenance to maintain appropriate depth and remove foreign matter.	See specific materials.	Provides useful "props" to support dramatic play. Children can manipulate the material itself. Some types of organic loose materials increase playground accessibility for individuals with disabilities.	See specific materials.
Depends on equipment height: 10-12 inches minimum; 18-36 inches for sand play area.	As above.	Inaccessible to wheelchairs or ambulatory disabled; should not be eliminated from play areas because of its play value.	High value for manipulative play, especially when access to water (faucet or water element) is also provided.	$15-20/ton.
4-8 inches. (Depends on Equipment Height)	As above.	Wheelchair accessible; inaccessible for ambulatory disabled who may experience balance problems when walking on this surface.	Provides for increased play area access for individuals with disabilities. Chopped tire may have some manipulative play value.	$2.50-3.00/ sq. foot.
Ranges from 1-6 inches thick; desired thickness depends on the equipment height and product resiliency.	Generally minimal.	Accessible.	Provides for increased play access for individuals with disabilities.	$5-$13/sq. foot depending on thickness and product resiliency.

SUMMARY OF SURFACING MATERIALS FOR USE UNDER PLAY EQUIPMENT

MATERIAL	FALL ABSORBING CHARACTERISTICS	ADVANTAGES	ISSUES TO CONSIDER
ORGANIC LOOSE MATERIAL (pine bark, bark nuggets, shredded bark, cocoa shell mulch, etc.)	Air trapped within loose materials provides a cushioning effect. An adequate depth of material must be provided to have this effect.	Low initial cost. Ease of installation. Attractive. Less abrasive than sand. Good drainage. Does not attract cats and dogs.	Environmental conditions can reduce fall absorbency. Susceptibility to burning. Ideal for microorganism growth when wet. Increased problems with wood post deterioration. Can get thrown around. Concealed animal excrement and sharp objects.
Bark Nuggets	As above	Bark nuggets from 1/2-1 inch screen size are a principal wood product used for surfacing under play equipment.	Softness accelerates its decomposition process. Some children are allergic to bark dust. Initial cost and maintenance requirements make it an expensive alternative.
Wood Chips	As above. Chips come in different sizes; the smallest chips work best.	Preferable to bark nuggets: lower cost, ease of maintenance. Easier to police for broken glass. Readily available.	Suitability depends on the wood source

RECOMMENDED DEPTH	MAINTENANCE REQUIREMENTS	ACCESSIBILITY	PLAY VALUE	COST
10-12 inches (Depends on Equipment Height)	Requires replacement and continuous maintenance to maintain appropriate depth and remove foreign matter.	See specific materials.	Provides useful "props" to support dramatic play. Children can manipulate the material itself. Some types of organic loose materials increase playground accessibility for individuals with disabilities.	See specific materials.
10-12 inches (Depends on Equipment Height)	As above.	Challenging: requires upper body strength of wheelchair users; ambulatory disables may find walking difficult.	Provides useful "props" to support dramatic play. Children can manipulate the material itself. Provides some degree of playground accessibility for individuals with disabilities.	$12-25/cubic yard.
10-12 inches (Depends on Equipment	As above.	Wheelchair accessible once matted down: challenging for ambulatory disabled who may experience balance problems on uneven surfaces.	Provides useful "props" to support dramatic play. Children can manipulate the material itself. Provides some degree of playground accessibility for individuals with disabilities.	$80-95/10 cubic yards.

APPENDIX G

PLAYGROUND INSPECTION CHECKLIST

Region_____ Date_____
Forest_____ Inspected by_____
District_____
Campground_____
Area_____

	SAFE	UNSAFE
PROTECTIVE SURFACING UNDER EQUIPMENT		
Compacted		
Displaced or ineffective level		
Doesn't extend to potential impact area		
Worn or scattered		
Unsanitary		
Poor drainage		
Broken glass, trash, rocks, etc.		
FOOTINGS		
Exposed		
Cracked		
Properly protected		
Loose in ground		
SWING SEATS		
Missing		
Damaged or loose swing seats		
Heavy seats with sharp edges or corners		
LADDERS AND STEPS		
Missing rungs or steps		
Broken		
Loosened		
Warping or bending		
Visible cracks		

	SAFE	UNSAFE
GUARD OR HAND RAILS		
Missing		
Bent		
Broken		
Loosened		
MECHANICAL DEVICES AND OTHER MOVING PARTS		
Lack of lubrication on moving parts		
Worn bearings		
Missing protective covers		
Worn swing hangers and chains		
Deformation of open hooks, shackles, rings, links, etc.		
EDGES		
Protruding bolt ends		
Caps and covers missing		
Sharp points or edges		
HARDWARE		
Loose bolts, nuts, missing, bent, broken, loosened, etc.		
SURFACE FINISH		
Splintered		
Checking		
Cracked		
Deteriorated wood		
Harmful preservatives or points		

	SAFE	UNSAFE
STRUCTURES		
Visible cracks		
Bending		
Warping		
Loosening		
Breakage of any component		

SUMMARY OF WORK NEEDED:

APPENDIX H

IDEAS AND QUESTIONS FOR MANAGEMENT

1. What age children will be using the space?

   Separate age groups by providing activities that appeal primarily to younger children and scale equipment accordingly.

2. How many children will be playing at the same time?

3. Depending on budget constraints, consider purchasing equipment in phases.

4. Playgrounds make excellent Challenge Cost Share Projects.

5. Where will the playground be located?

6. Consider proximity and relationship to restroom facilities.

7. Consider the scale of the space in which the play structure will be placed. Small skimpy wood structures tend to look lost. The large massive timber structures fill the spaces and attract the people.

8. If the playground is located in a camping loop, consider locating at one end or the other in order to encourage circulation along loop roads rather than through designated camp sites.

9. Consider lighting playgrounds for night use.

10. Is the product (example: playground system, safety surfacing, etc.) backed by a strong warranty and a reputation for customer service and support after the sale?

11. Can the playground systems be easily installed by force account crews, volunteer groups, etc.?

12. Does the playground equipment have play value? Is it exciting and challenging? Can the children set their own limits, give them choices, and let them make decisions?

13. Are the structures themselves designed correctly, with hand-holds and guard rails where needed?

14. Do the structures have a variety of ways on and off so that several children can play together, and small children can find a comfortable way down? No part of a structure should be a dead-end street.

15. Provide seating to encourage parental supervision.

16. Allow ample space between activities and components. Allow a minimum spacing of 6-feet between nonlinked pieces of equipment and between equipment and fences or walls. Allow 8-foot clearances at slide exits.

17. Prevent burns by eliminating unpainted metal surfaces or providing shade. Slides, if used, should be oriented toward the north to reduce heat build-up from direct sun. Metal platforms, if used, should be designed with canopy covers. In general, several shady areas should be provided within the play environment in hot climates.

18. Before choosing playground surfacing, determine the amount of time your people will be able to devote to maintenance (example: organic materials such as pine bark mini-nuggets will require replacement and continuous maintenance such as leveling, grading, and sifting to remove foreign matters in order to remain effective as cushioning materials).